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Cotton Production in AFRICA

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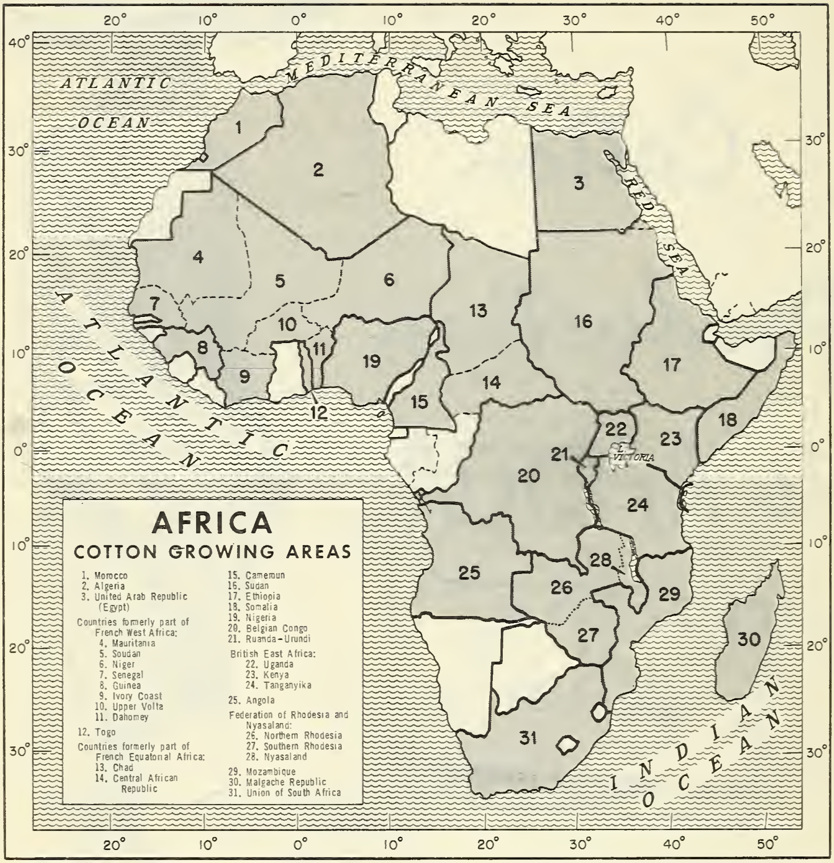

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FOREWORD

African cottons are known and respected throughout the import markets of the world. While Africa continues as a net importer of cotton textiles, its own textile industry is supplying an increasing proportion of its textile requirements.

These and other factors associated with the rapid economic growth of this vast continent make it imperative that the Foreign Agricultural Service closely follow cotton developments in Africa as they are revealed not only by official government reports and by information obtained from reputable scientific organizations and other sources, but by on-the-spot investigations. For example, three American cotton scientists visited areas in Africa during the 1957-58 marketing year. These areas produce, in the aggregate, about 95 percent of all the cotton in Africa. This report draws upon their first-hand observations, plus the close and continuing study of subsequent developments. It is, therefore, presented as an up-to-date analysis of cotton in Africa.

Egypt, Sudan, Tanganyika, Mozambique, Kenya, and Uganda were visited by Horace G. Porter, Agricultural Economist, Cotton Division, Foreign Agricultural Service, USDA; French West Africa, Nigeria, Cameroons, French Equatorial Africa, Belgian Congo, Ruanda-Urundi, Uganda, and Sudan were visited by Thomas R. Richmond, Agronomist, Cotton and Cordage Fibers Research Branch, Crops Research Division, Agricultural Research Service, USDA, cooperating with the Texas Agricultural Experiment Station, College Station, Texas; and French West Africa, Togo, Cameroons, French Equatorial Africa, Belgian Congo, Ruanda-Urundi, and Uganda were visited by Dr. Meta S. Brown, Cytogeneticist, Texas Agricultural Experiment Station, College Station, Texas.

The Foreign Agricultural Service is especially grateful to the Agricultural Research Service for permitting Dr. Richmond to assist with this study.

R. C. Sherman
Director, Cotton Division

Credit for photographs is given as follows: Sudan, Central Office of Information; Nigeria, British Information Services; Tanganyika, Public Relations Department; Uganda, Department of Information. Other photographs from authors.

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Especially to be thanked for their role in making it possible for Dr. Richmond to make his extended trip through cotton-producing areas of Africa are the French, Belgian, and British Governments; the cotton research organizations of these countries--France's Institut de Recherches du Coton et des Textiles Exotiques (IRCT), Belgium's Institut National pour l'Etude Agronomique du Congo Belge (INEAC), and Britain's Empire Cotton Growing Corporation (ECGC); and the International Educational Exchange Service of the U. S. State Department.

The debt of the authors also extends to the numerous writers of reports on Africa and to the people who have reviewed this manuscript and made helpful suggestions concerning it. Dr. Meta S. Brown, who was in Africa with the authors, is due especial mention for her valued assistance in seeking out needed information while on the trip, in helping to piece out and interpret the information gained, and also in carefully reviewing the manuscript.

CONTENTS

Page

Summary and conclusions........................... 1
Introduction.. 3
Cotton production:
  Major producing areas 3
  Acreage, yield, and production.................. 4
  Varieties 9
  Production practices 16
  Competition for resources 23
How cotton moves in trade 25
Domestic textile industry and cotton consumption.... 30
Prospects for cotton development 33
  Development plans 33
  Impediments 39

COTTON PRODUCTION IN AFRICA--
Trends and Prospects

By
Horace G. Porter[1]
and
Thomas R. Richmond[2]

SUMMARY AND CONCLUSIONS

Cotton, already an important crop in Africa, is gaining in economic significance in many of its traditional areas of production and is expanding into new areas. Although at present only a small percentage of the total land area is in cotton and the percentage of the world crop accounted for by Africa is also comparatively small, the trend for both percentages has been definitely upward during the past several years.

South of the Sahara numerous forces are contributing to the expansion of cotton production. Among these is the encouragement over the years from affiliated European areas to expand cotton production and thereby reduce the foreign exchange requirements of the European countries' domestic textile industry. Pressure to earn foreign exchange is another. A third is the general desire of both European and African leadership to see developed a reliable source of cash farm income for farm families in Africa. Cotton is believed to be the crop that best performs this function in many areas.

A considerable amount of high-quality basic and applied research work has been performed in Africa on cotton and cotton problems. As a result there are well-suited varieties for most cotton-producing areas of Africa. Furthermore, the research workers have determined certain simple steps which if taken by the native cultivator would significantly raise the yield of, and income from, cotton. Even so, in many areas the rate of progress has been discouraging to the local professional agricultural leadership. And yet, in other areas the rate of progress has been rapid. Progress there serves to maintain the faith of research and extension workers and administrative personnel stationed elsewhere that eventually a significant proportion of the farmers in their areas also will adopt the recommended practices and that cotton can and will serve an even more important role in their economy. No one can know how long this will take, but the indications are that for Africa as a whole the trend will be one of gradual increases in cotton production. Limited areas may, however, show spurts of rapid progress such as has been seen in Tanganyika.

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Although Africa accounts for only 8 percent of world cotton production, its production of extra-long staple cotton accounts for some 70 percent of the world total. Egypt and Sudan are the world's leading producers of this extra-long staple. Egypt also has considerable production of shorter Egyptian-type cotton, and small quantities of Egyptian-type cotton are being grown in several other areas.

The production of extra-long staple cotton has been expanding rapidly in recent years. Consumption has failed to keep pace. As a consequence, prices of these cottons declined; yet burdensome surplus stocks accumulated in producing countries during the past few years. In the 1959-60 season, however, these cottons have moved in better volume.

Investment--both public and private--will be a necessary part of economic development in Africa in the years ahead. Those in a position to determine policy must decide what emphasis is to be placed upon expanded cotton production. Among the numerous factors to be considered is present and prospective supply and demand, not only for the different kinds of cotton but also for each of the alternative crops that might be produced.

Many observers outside of Africa undoubtedly will feel that little of the new capital to be invested in Africa in the years ahead should be committed to cotton production. Such a view would be based on the world supply and demand situation now existing in cotton and likely to exist for some years to come. Despite all of the logic of such a position, it may have but little overall effect on the actual sequence of events in Africa.

If, as some competent observers predict, Africa succeeds in resolving its political and social difficulties and a sound and imaginative program of economic development and industrial expansion emerges, the cotton export picture in the years ahead might undergo material change. Production of the medium-stapled "bread and butter" cottons is expected to continue to increase. So are mill consumption and consumer purchases of cotton textiles in Africa as a whole. Thus, something less than the full increase in cotton production will be added to Africa's net export surplus in the years ahead. The net export surplus will be smaller still if one corrects for the cotton content of net textile imports into African areas. As regards Egyptian-type cottons, which go mostly into specialty and premium-quality products, there is the possibility that production and exports will both increase. However, a widespread shift from Egyptian to Upland-type cotton could alter this prospect. The export picture for Egyptian-type cotton might also be changed if Egypt succeeds in becoming an important exporter of fine yarns and fabrics instead of continuing primarily as an exporter of raw cotton.

Still another factor that will affect the level of cotton production and exports in the years ahead is the need to expand food production in Africa. Given favorable conditions, the expanding population and rising level of living would intensify the pressures to expand food production in Africa. There would therefore be even more competition between cotton and food crops for the limited acreages of really good agricultural land.

INTRODUCTION

Cotton is one of Africa's most widely grown commercial crops. The area devoted to this crop in recent years has averaged between 8 million and 9 million acres, and average production has been between 3 million and 4 million bales. This represents some 8 percent of world production. While this amount seems small when viewed against the much larger production in the United States, it is still a substantial and expanding quantity, and most of it goes into international trade. Cotton production in Egypt increased 18 percent from 1950 to 1959. Production in the rest of Africa, however, increased about 45 percent during the same period.

This expansion stems from a number of factors. Research, extension activities, and general promotion have all been effective. So have periods of unusually favorable financial returns. These and other aspects of cotton in Africa are dealt with in the following sections, and an attempt has been made to appraise future trends.

COTTON PRODUCTION

Major Producing Areas

In recent years approximately three-fourths of all of the cotton produced in Africa has been grown in the Nile River Valley or in the Nile drainage basin. All of the cotton in Egypt and nine-tenths of the crop in the Sudan is produced in the valley or delta areas along the Nile River. A considerable part of the production in Uganda, Tanganyika, and Kenya is grown on the arable lands around Lake Victoria which constitute the southern reaches of the Nile Basin. In contrast to the crop in Egypt and most of the Sudan, which is grown under irrigated conditions from water obtained from the Nile, the crop in the Lake Victoria region is rain grown (nonirrigated).

Other major cotton-producing areas are found in the Belgian Congo, Nigeria, Mozambique, and the countries of former French Equatorial Africa. These four general areas account for about 20 percent of African production, and all remaining African areas account for less than 5 percent of the total.

Acreage, Yield, and Production

Acreage. --Immediately after World War I, countries with control over African areas took steps to stimulate cotton production. The generally high level of cotton prices during the early part of the interwar period reflected both an active demand for raw cotton by the world's mills and the limited export availabilities that resulted mainly from heavy boll weevil damage to U. S. production.

In the Belgian Congo, the land devoted to cotton more than doubled from 1920-24 to 1925-29. In the Sudan, the increase was over 150 percent and in Uganda, the gain was about 75 percent.

Egypt, however, had staged its big expansion in cotton production somewhat earlier, and by 1920 had more or less reached the maximum acreage, in terms of good land, the need for food production, and available water. Year-to-year fluctuations since then have been moderate and generally without any particular upward trend.

Since data on the total acreage of cotton in Africa are incomplete for the period 1920-24, the total average annual cotton acreage shown in table 1 for this period probably understates the actual acreage. Conversely, the gain from 1920-24 to 1925-29 may be slightly overstated.

World War II caused a number of major changes in the cotton economy of African areas. Many faced reduced export outlets for cotton when large parts of the world were cut off from normal supplies. In addition, some that normally produced cotton for export had to emphasize the production of food, since food imports were no longer possible. Still others maintained their emphasis on increased production of cotton.

The Korean conflict and the consequent skyrocketing of cotton prices in 1950-51 did much to start an expansion of cotton acreage in a number of African areas. However, in some areas the price paid farmers for seed cotton was held far enough below the world level that sizable surplus funds were accumulated by the various marketing boards or agencies. The greater part of these surplus funds has been held against the time when needed to support prices paid to farmers in a depressed world market. Considerable amounts have been spent for research, development, and promotion.

Although the full impact of the higher prices in 1950-51 was not brought to bear on acreage, plantings did increase and the 1950-54 average acreage was 35 percent above the average for the preceding 5 years. Acreage has continued to gain, the total of 9. 3 million acres of cotton in all of Africa in 1958-59 being the highest on record and 21 percent above the 1950-54 average. Most African areas currently are at or near their alltime high. The only notable exception of any size is the Belgian Congo.

TABLE 1.--Cotton: Acreage, averages 1920-54, annual 1955-59

Country	Average							1955	1956	1957	1958[1]	1959[1]
	1920-24	1925-29	1930-34	1935-39	1940-44	1945-49	1950-54					
	1,000 acres	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*	*1,000 acres*
Algeria..................	1	15	3	---	5	2	19	26	19	16	17	5
Angola...................	---	10	12	73	115	121	124	128	132	130	127	128
Belgian Congo............	123	253	476	874	923	745	863	850	850	840	855	865
Egypt....................	1,748	1,828	1,743	1,821	1,162	1,367	1,832	1,885	1,715	1,888	1,977	1,827
Federation of Nyasaland and Rhodesia................	78	53	39	86	61	69	82	93	30	24	26	26
Fr. Equatorial Africa......	8	17	154	390	583	610	838	800	785	895	[2] 900	[2] 900
Fr. West Africa...........	---	---	---	200	194	79	181	200	227	250	[2] 300	[2] 300
Kenya....................	---	---	---	65	105	51	73	140	75	85	100	125
Morocco..................	---	---	---	1	5	3	9	12	15	17	17	17
Mozambique...............	---	50	65	200	497	557	690	725	743	745	750	750
Nigeria..................	---	---	---	200	176	204	463	750	750	850	800	800
Sudan....................	105	269	349	439	363	371	614	598	764	728	887	945
Tanganyika...............	---	154	108	250	225	165	209	300	300	400	400	450
Uganda...................	349	615	991	1,477	1,152	1,324	1,574	1,585	1,569	1,617	2,014	1,675
Union of South Africa[3].....	52	64	24	14	8	12	66	100	100	100	100	100
Other....................	42	412	329	33	33	23	40	85	61	54	53	52
Total................	2,506	3,740	4,293	6,123	5,607	5,703	7,677	8,277	8,135	8,639	9,323	8,965

[1] Preliminary. [2] Separate country statistics not yet available. Former French Equatorial Africa includes Gabon, Central African Republic, Congo, and Chad. Former French West Africa includes Ivory Coast, Dahomey, Upper Volta, Mauritania, Niger, Senegal, Soudan, and Guinea. [3] Including Swaziland.

Foreign exchange considerations too have played a part in stimulating cotton production in some African areas. Expanded cotton production in colonial areas is a recognized means of decreasing the foreign exchange expenditures of the mother countries or adding to their foreign exchange earnings.

In the producing areas themselves, foreign exchange considerations frequently appear to have been overshadowed by the realization that under the prevailing conditions of subsistence farming a generally reliable cash crop was badly needed to improve the low levels of living. In many areas cotton promised to meet this need. Experience has demonstrated that while some of this confidence was well founded, cotton did not work out satisfactorily everywhere. Numerous factors have caused cotton either to fail or to give way to other crops. Some are natural or physical factors--soils, weather, insects, and diseases. The indifference of the native populations to cotton production has deterred expansion in some areas. Another factor that has caused cotton to make slow headway and, on occasion, even to lose ground, is the competition it has faced from other crops--either food crops or other cash crops, such as peanuts, rice, or coffee. A third factor is the weakness of the profit motive.

A cash crop, to many an African, is simply a way of obtaining some specific nonfarm product, such as cloth, a bicycle, or a tin roof. In many areas, one hears of farmers who harvest only enough cotton to pay for some particular purchase of this kind. Not all farmers fall in this category, of course, since others are influenced to a greater extent by the profit motive.

Yield. --Considering the wide range of conditions under which cotton is grown in Africa, a look at average yields over a period of years can be grossly misleading. For example, it would be possible, theoretically, for the actual per acre yields in both high-yielding and low-yielding areas to increase, and yet because of a more rapid expansion of acreage in the low-yielding areas, or decreases in acreage in high-yielding areas, or both, average annual yields for the total region in question could remain constant or even show a decrease.

The situation in Sudan and Uganda falls somewhat within this pattern. In Sudan, wide differences in yield levels are found between the gravity irrigation areas of the Gezira and the pump irrigation schemes on the one hand and the flood irrigation and rain-grown areas on the other. The future trend in average per acre yields for the Sudan as a whole depends on what takes place under these systems of irrigation as well as on how much rain-grown production is expanded. In Uganda, where all of the crop is rain grown, yields in the "Fertile Crescent" near Lake Victoria are approximately double those in the drier areas farther north. Because of the profitableness of coffee in the Fertile Crescent, cotton acreage has been declining rather sharply, but in the north it has increased, even more sharply.

The yield figures for Tanganyika are more indicative of the true improvement that has taken place in that area. Varieties higher yielding than those formerly produced have been developed and brought into general use. However, the extension of cotton production into fairly fertile new areas has also been a factor in raising average yields.

In some parts of Africa where annual rainfall would seem to be adequate, the rainy seasons are so short that supplemental irrigation during drought periods would increase yields significantly. Irrigated cotton is grown on the lands of the Office du Niger in the Soudanese Republic, around Upington in the Union of South Africa, along the Limpopo River in Mozambique, inland from Tanga in Tanganyika, in the Ruzizi Valley of Ruanda-Urundi, and in Morocco and Algeria. In some of these places irrigated cotton is still in or barely past the experimental stage. Thus it remains to be seen how important a role irrigation will eventually play in African cotton production. Still, any increase in the acreage of irrigated cotton in the various countries where cotton is now predominantly rain grown will tend to raise the average yield per acre.

Production. --The changes in acreage have been far more striking than those in yield. It is not surprising, therefore, that Africa's production trends follow acreage more closely than yield.

In 1935-39, Africa's cotton production averaged nearly twice as much per year as in 1920-24. Production in Egypt also increased sharply. Even so, Egypt's share of total African production declined from 87 percent in 1920-24 to 67 percent in 1935-39. In other words, while Egypt itself was making what might be considered as rapid expansion, other areas in Africa were making even more spectacular gains.

World War II had a tremendous impact upon the cotton situation in Egypt. The disruption to world shipping was such that some countries could obtain only greatly reduced quantities of Egyptian cotton, while others were entirely cut off. It was virtually impossible for Egypt to import the usual quantities of food products. As a consequence, Egypt diverted large acreages from cotton to grains and other food crops, and its average cotton production in 1940-44 fell even below the 1920-24 level. Cotton has since recovered, however, and 1959 production is estimated to have been second only to the record 2.3 million-bale level reached in 1937.

Production in the Sudan held fairly steady at the 1935-39 level throughout the decade of the 1940's but has since moved sharply upward to a level of well over 600,000 bales in 1959. This is 15 percent of total African production, compared with 9 percent in 1935-39 and 2 percent in 1920-24.

African production outside of Egypt and Sudan has continued its upward trend, with each successive 5-year average since 1920-24 showing an increase over the preceding one. Combined production in these areas is estimated at between 1.3

TABLE 2.--Cotton: Production, averages 1920-54, annual 1955-59

Country	Average							1955	1956	1957	1958[1]	1959[1]
	1920-24	1925-29	1930-34	1935-39	1940-44	1945-49	1950-54					
	1,000 bales [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]	*1,000 bales* [2]
Algeria....................	1	6	---	---	1	---	8	10	6	3	2	1
Angola....................	3	3	3	13	24	24	25	32	31	30	29	35
Belgian Congo.............	9	26	72	172	182	195	222	246	239	205	225	230
Egypt.....................	1,281	1,587	1,482	1,893	1,243	1,456	1,705	1,535	1,492	1,861	2,048	2,074
Federation of Nyasaland and Rhodesia................	7	9	8	12	8	10	13	5	6	9	13	11
Fr. Equatorial Africa......	1	1	14	41	87	104	135	165	155	185	[3] 185	[3] 188
Fr. West Africa............	---	32	---	28	20	14	30	45	52	57	[3] 70	[3] 70
Kenya.....................	2	1	4	13	21	6	11	14	7	10	15	15
Morocco...................	---	---	---	---	2	1	5	7	9	10	9	10
Mozambique................	2	11	11	33	93	104	148	102	158	140	215	160
Nigeria...................	---	29	22	36	30	48	114	150	135	215	155	150
Sudan.....................	30	125	159	248	253	246	383	441	517	225	573	625
Tanganyika................	8	20	20	50	45	38	55	100	111	140	143	163
Uganda....................	91	131	206	281	198	227	291	303	310	292	330	250
Union of South Africa[4].....	6	11	3	2	1	3	23	29	31	28	31	39
Other.....................	36	26	57	7	4	5	11	21	16	7	13	13
Total.................	1,477	2,018	2,061	2,829	2,212	2,481	3,179	3,205	3,375	3,417	4,056	4,034

[1] Preliminary. [2] Bales of 478 pounds net before 1946 and 480 pounds thereafter. [3] Separate country statistics not yet available. Former French Equatorial Africa includes Gabon, Central African Republic, Congo, and Chad. Former French West Africa includes Ivory Coast, Dahomey, Upper Volta, Mauritania, Niger, Senegal, Soudan, and Guinea. [4] Including Swaziland.

million and 1.4 million bales in 1958 and 1959. At this level, these areas now account for 34 percent of total African production, compared with 24 percent in 1935-39 and 11 percent in 1920-24.

In the 1920's, Uganda was a poor second to Egypt among African cotton-producing areas. A sharp upward trend carried Uganda's production to a peak of 349,000 bales in 1937; its 1935-39 average was three times that of 1920-24 and a closer second to Egypt's. As with Egypt, however, World War II forced a reduction in Uganda's cotton production. Following the war, production was substantially restored, the 1958-59 level of production being 330,000 bales. Sudan has now moved ahead into second place in African production.

The production stories of the Belgian Congo, Mozambique, and the area formerly known as French Equatorial Africa show marked similarities. In each area, production was negligible in the early 1920's. In succeeding 5-year periods, it showed fairly regular increases. Since 1954, production records have been established in the Congo, Mozambique, and the French Equatorial area.

Annual production data show that for the years of record before 1950 cotton production in Nigeria ranged from a high of 61,000 bales in 1940 to a low of 13,000 in 1944. During the same period, production in Tanganyika ranged from modest levels to as high as 61,000 bales in 1941. Throughout the period before 1950 the fluctuations were wide, but there was nothing like the sharp upward trend that has since been in evidence. Starting in 1950 when production established a new high of 75,000 bales, Nigerian production has risen sharply, reaching a peak of 215,000 bales in 1957. In Tanganyika, production has increased from 41,000 bales in 1950 to an estimated 163,000 bales in 1959-60.

Other countries and areas in Africa together have accounted for from 145,000 to 180,000 bales of cotton annually in each of the past several years. None of these areas seem to be having any strong upward trend currently, and some are actually experiencing a decline.

Varieties

The cotton grown commercially in Africa is about two-thirds Gossypium barbadense, or Egyptian-type cotton, and one-third Gossypium hirsutum, or Upland-type cotton. The two types are distinct botanical species. With one minor exception the Egyptian or barbadense cottons, grown predominantly in Egypt and the Sudan are characterized by relatively long, fine, strong fibers and are adapted to production under irrigation. The Upland or hirsutum cottons are for the most part shorter in staple length, coarser, and whiter in color than the Egyptian cottons, but most of the varieties are somewhat longer and finer than the "bread and butter" cottons of the American Cotton Belt.

Egyptian Types.--Egypt produces more varieties of Egyptian-type cotton than any other country and can thus offer customers a fairly wide range of staples and other fiber properties. For some years Karnak, which is produced in the northern part of the Delta, dominated the long end of the market for Egyptian cotton and Ashmouni, which is produced south of the Delta, dominated the short end. These two varieties accounted for 40 percent and 34 percent, respectively, of Egypt's total acreage during the period 1951-55. Menoufi, which is slightly shorter than Karnak, accounted for an additional 3 percent and Giza 30, which is slightly longer than Ashmouni, accounted for 20 percent. All other varieties combined accounted for 3 percent. More recently, and for reasons partly explained below, Karnak accounted for 15 percent of the 1959 acreage, Menoufi for 38 percent, Ashmouni for 31 percent, Giza 30 for 7 percent, and all other varieties for 9 percent.

Despite the enviable reputation of at least some of these varieties and many past varieties, continuous vigilance and hard work have been required to maintain and improve the quality of Egyptian cotton. For example, the original Menoufi was never a particularly popular cotton. Through careful work Egyptian breeders were able to develop and issue a new and what is reportedly regarded as a vastly superior Menoufi. Karnak has followed a different course. For years it was highly regarded, but of late the quality of this variety has deteriorated to an extent that has caused considerable alarm both in Egypt and abroad. Giza 30 also has shown serious deterioration.

In the past it was recommended that farmers in the Northern Delta grow Karnak, but Ashmouni was the only variety they were prohibited from growing. Similarly, Menoufi was recommended for the Middle Delta and Giza 30 for the Southern Delta, but only Karnak and Ashmouni were barred in these areas. Upper Egypt could grow only Ashmouni and Giza 31 (Dandara).

The mixing of the seed of various varieties has been attributed to the lack of strict regulations on areas of growth, on control of ginning, and on handling of planting seed, and to failure to comply fully with the regulations that do exist. These factors were particularly obvious and damaging in Karnak and Giza 30. In an effort to increase the purity of the different cotton varieties, the Egyptian Council of Ministers, in its session of December 29, 1957, approved the allocation of certain areas for each variety. The results were expected to benefit both the producers and the users of Egyptian cotton. In 1959, owing to a considerable carryover of the extra-long-staple cotton, the area allotted to the medium-long varieties such as Giza 30 and Giza 47 was expanded and that for Karnak was reduced. A special zone was established for Giza 45. Also, gins are now prohibited from ginning more than one variety of cotton.

While these tightened regulations, if faithfully carried out, will prevent further serious mixing of varieties, the job of replacing existing mixed seed stocks exists. A ministerial order made a start at this in 1958-59 by forbidding the use of Giza 30 seed other than that produced by the Ministry of Agriculture and the Agricultural Organization. In other words, farmer-produced seed was not acceptable for planting in 1958-59, even though checked by the Seed Testing Section of the Ministry of Agriculture.

The Egyptians now consider Giza 45 to be the Egyptian variety of best spinning value. They describe it as similar to Karnak in fiber length, although finer and giving a yarn about 15 percent stronger than Karnak at its best. Giza 45 was planted on about 14,000 acres in 1959. Giza 47 has lint characteristics more or less like those of Giza 30 but is darker in color and reportedly has better spinning value. Its 1959 crop occupied about 39,000 acres.

Other new varieties that have shown such promise that their seed supply is being multiplied are listed and described by the Egyptians as follows:

Giza 51: Attractive light-color regular staple, with almost Giza 7 characteristics, but higher in spinning value. About 2,000 acres were planted to this variety in 1958.

Giza 58: Higher in lint yield and better in spinning value than Giza 30 but darker in shade.

Giza 66: Almost Ashmouni characteristics, slightly better in spinning value but higher in yields.

Bahtim 185: Slightly longer and finer than Ashmouni and of better spinning value. About 4,000 acres were planted to this variety in 1959.

In the Sudan, Domains Sakel (S-type) and Lambert (L-type) are the broad types of Egyptian cotton grown. There are various strains within each type. Domains Sakel, which is the dominant S-type variety, is produced in the northern part of the Gezira and in a part of the Gash Delta; L-type cotton is grown in the remainder of the Gezira, some of the flood-irrigation river basins, and almost all of the pump schemes.

The original Domains Sakel was vulnerable to both leaf curl and bacterial blight. Both diseases have affected cotton severely in some parts of the Gezira. About 1927, A. R. Lambert, who was in charge of cotton breeding in the Sudan, selected from the Sakel crop some plants that suffered less damage from leaf curl than the original stock. This was the beginning of the L-type variety X1730. Additional breeding work to improve resistance to bacterial blight was done by R. L. Knight. The two L-type varieties now produced commercially are X1730A and BAR XL1. This latter variety is now in general use on the portions of the Gezira that are more heavily infested with bacterial blight and on all private pump schemes on which Egyptian-type cotton is produced.

Any expansion of cotton acreage on the present or additional private pump schemes in the Sudan will probably involve further use of BAR XL1 cotton. A blight-resistant long-staple S-type cotton (variety BAR 14/25S) was planted on the first stage of the Managil Extension to the Gezira and BAR XL1 was planted on the second phase. Trial plantings of several other *barbadense*-type varieties, including the American-Egyptian variety Pima S-1, are being made.

Sudan has won the admiration and respect of the entire cotton world for its success in maintaining the purity of its Egyptian-type cotton. This achievement has been the result of a carefully developed and rigidly enforced system that has encompassed every phase of the industry. The government's task of safeguarding the purity of its planting seed would be considerably increased by a decision to produce a substantially more diversified group of varieties. The possible benefits would be (1) use in some areas of varieties that would be better suited from the standpoint of disease resistance, yield, and fiber properties--and thus more profitable--than the varieties now being produced, and (2) possibly better adaptation to the world supply and demand situation.

Against these possible benefits must be arrayed the following items: (1) The time and effort involved in developing the additional varieties and the subsequent cost of continuing to improve them; (2) the additional cost and effort associated with maintenance of pure seed stocks of each of the varieties of cotton grown in the Sudan; and (3) the prestige losses that would be associated with failure to do an adequate job of seed stock maintenance.

Experimental work with Egyptian stocks has been conducted in a number of other African areas, and indications are that it has passed the purely experimental stage, and that some commercial production is getting under way in Morocco, Algeria, and Somalia. How far and how fast it expands in these areas will be governed in part by the competitive position of Egyptian-type cotton relative to both Upland-type cotton and other farm crops in the potential producing areas. The rate of development, if any, also will reflect fundamental policy decisions at the governmental level.

The Portuguese program on the adaptation and improvement of Egyptian-type cotton in Mozambique and Angola is built around the Giza 7 variety. A start toward commercial production is being made on the large development project in the Limpopo Valley of Mozambique.

Several thousand bales of coarse-short fibered type of *barbadense* cotton are grown annually in the more humid regions of Ivory Coast and even more limited quantities are grown in similar regions of Togo, Dahomey, and Nigeria. Breeding and seed-multiplication work on this stock is conducted in Ivory Coast and in Togo; the current variety being distributed bears the name Mono 54. This variety was bred from the old *barbadense* stock, which in Nigeria is called Ishan. Most of the Mono 54 cotton produced in Ivory Coast is spun locally. The Togo and Dahomey production which is not consumed in the villages is exported. In Nigeria the Ishan stock is not maintained under an organized seed program.

Natives grow the cotton in small plots or gardens in the villages and maintain their own seed. The stock is highly variable and usually mixed with Upland types. The small quantity of cotton produced is practically all separated from the seed, spun, and woven into rough cloth by hand in the villages. The Mono or Ishan types are adapted to growing in mixed cultures, and a considerable portion of the crop is produced in mixed plantings with corn, cassava (manioc), and other food crops.

Upland Types.--Most of the Upland varieties of cottons in Africa trace back to Allen, Triumph, and similar obsolete types which were obtained from the United States about the turn of the century. However, certain hirsutum stocks, such as the Cambodias and certain members of the race punctatum, were introduced into the area without having first been grown in the American Cotton Belt. Modern Upland varieties in Africa show signs of introgression of these "non-American" Uplands with the Allen stock. In fact, practically all of the Upland varieties currently being distributed to native farmers are now so distinctly differentiated from their American prototypes that most cotton scientists would characterize them as African rather than American Uplands.

Current American Upland varieties are tested from time to time at various experiment stations in Africa, but they seldom measure up to the locally bred stocks either in production or in the fiber properties desired. In the northern cotton region of the Belgian Congo the seed stocks distributed to farmers originated in a relatively recent introduction of Stoneville, a well-known U. S. Cotton Belt variety. But even here, the stock is being replaced with locally bred material--which has proved to be more generally satisfactory than the American stock--as rapidly as the new seed stock can be multiplied.

Traditionally Upland-type cotton has not been grown commercially on the Gezira, but there have been experimental plantings. The crisis in extra-long-staple cotton in recent years has resulted in a decision to plant some Upland cotton and other cash crops as a substitute for extra-long-staple varieties on some of the land under the control of the Sudan Gezira Board.

Sudan has the largest number of Upland varieties of any African area. In part, this is explained by the wider range of conditions under which Upland cotton is produced. Certain Upland varieties from the United States are being field tested, but most of the stocks in the Sudanese production trials have been developed by the Empire Cotton Growing Corporation at one or more of its cooperative stations in Africa. Some Coker Wilds 11 and Wilds SUS 16/1 are grown under pump irrigation. Upland varieties BAR 7/8-1 and BAR 11/7 are produced under flood irrigation along the Abu Habl River southwest of Kosti. About 8,000 acres of Acala 4-42 were grown in 1959. This variety has been tentatively selected for planting when the third phase of the Managil Extension of the Gezira comes into operation.

By far the greater share of the Upland cotton thus far produced in the Sudan is rain-grown. The principal area is in the Nuba Mountains of Kordofan, where BAR 7/3 and BAR 7/8-1 were reportedly the dominant commercial varieties in 1958-59. However, indications are that in at least some areas these varieties will give way to either BAR 11/7 or BAR 7/8-2. In Equatoria Province BAR 7/8-1 is grown, and in the Gedaref and Upper Nile areas the varieties produced are BAR 7/3 and BAR 7/8-1.

A large number of varieties of Upland cotton are grown elsewhere in Africa, but in any given area it is the policy of the seed distribution agency concerned to standardize production on a single variety. For the most part, commercial varieties now being produced have been developed by experiment stations in the country where grown. An exception exists in Kenya, where the initial supply of seed of new varieties is obtained from Tanganyika and Uganda. In the Nyanza Province of Kenya, S-47 is raised north of a line running approximately northwest from Kisii to Lake Victoria, and UK-51 is raised south of this line. UK-51 is also grown in the Coast Province of Kenya.

In Uganda, BP-52 is grown south and west of the Victoria Nile and S-47 north and east of it. A new variety "DE-715/6M" has been selected for multiplication as an eventual replacement for the present stock of S-47, although the new strain will still be known as S-47. One of its characteristics is that it does not have a weak seed coat as does the present S-47. A new BP-52 multiline strain, bearing the experimental designation NC-54, was grown on 34,000 acres of the BP-52 area of Uganda in 1957-58. There was expected to be enough seed from this to cover the entire BP-52 area in 1958-59.

Tanganyika's principal cotton area is in the Lake Province. Currently, Lake Province cotton is UK-51, but a new strain UK-55 is due to replace UK-51. In the Eastern Province IL-58 has been selected for eventual replacement of 47/10.

In Nyasaland, Albar 637 is being multiplied with a view to its replacing the present commercial variety CLB, which it has consistently outyielded. Albar 637 may also be used in Southern Rhodesia to replace 9L34, which has been the commercial variety there for a number of years.

Production of Upland cotton in Mozambique has been from A618 seedstock but variety A-455 went into production in 1958.

In Northern Nigeria, where the production of Upland cotton has shown marked increases during the past decade, cotton breeding and performance testing has been going on for many years. Steady improvements in both yield potential and lint quality have been made. About 14 percent of the acreage is planted to Samaru 26J, a variety which has received the enthusiastic approval of British spinners and also performs well in the field.

Cotton breeding and adaptation research also has been under way for more than 40 years in the Belgian Congo. Two varieties, GAR and C_2, are currently in production in the southern cotton-growing regions of the Congo. Research and seed distribution officials point out that C_2, because of its resistance to disease and insects, in addition to its superior yield and fiber properties, will soon replace GAR entirely. In the Northern Zone, Bambesa 49 is being progressively introduced.

The French, though apparently the last to inaugurate a program of cotton research and development in the countries and territories south of the Sahara with which they are affiliated, have established a really comprehensive program in the past 10 to 15 years. The greatest production, as well as the greatest potential for production, occurs in the countries of former French Equatorial Africa, particularly in the Central African Republic (formerly Ubangi-Shari) and Chad. Varieties adapted to the varied growing conditions of this vast area have been developed by workers at strategically located experiment stations. The variety Bandi D-9, developed from Triumph stock obtained from the Belgian Congo, has recently been distributed to farmers throughout the savannah areas of the Central African Republic. Extensive tests have demonstrated its superiority over those formerly grown in the area. To the north, in the dryer climate of Chad, Allen 150 has in recent years replaced the older N'Kourala stock. Station workers and cotton officials report that a new strain which is superior to Allen 150 by some 20-25 percent will soon be in general production in that area.

In the Soudanese Republic, Upper Volta, Niger, and northern Dahomey, Allen 58-151 is replacing other varieties as rapidly as seed becomes available. In the areas controlled by the Office du Niger, Allen E-24 is the variety produced. Only a small amount of cotton is grown in the Malgache Republic. This cotton is divided between Acala and Stoneville.

Seed Stock Handling.--Some of the various countries have isolation areas where the seed of selected new varieties are multiplied for the purpose of placing them into commercial production. In all of the programs, large or small, great care is characteristically exercised to safeguard the purity of seed stocks and thus control to a reasonable degree the type and quality of fiber produced.

The task of keeping seed strains pure is less difficult in those African areas that have no home spinning and weaving, since all of the seed cotton in such areas passes into commercial channels. This arises out of the fact that where home spinning is practiced, as in the case of the Ishan cottons mentioned earlier, some of the crop is carried into native huts. Throughout the year following harvest the lint is separated from the seed by hand and the lint spun. Some of this seed frequently finds its way back into commercial fields, and thus directly or indirectly causes contamination in the tested pure stocks that are maintained and distributed by authorized agencies.

Since the African grower sells his cotton in the seed, he has to obtain new planting seed each season. The government or organization operating with the necessary authority is, therefore, in the position of being able to place varieties of known or tested characteristics in the hands of the growers and to change varieties at any time seed of an improved variety becomes available. Thus, by combining the ability of the plant breeder to develop improved varieties and the administrative arrangements for seed multiplication, chemical treatment, and distribution, it has been possible to bring about marked improvements in the cotton production of various African areas, even though the native cultivator fails to handle his crop in such a way as to obtain the highest potential yields or fiber quality.

The quality and scope of cotton breeding work in the various African areas is such that improvements and refinements in cotton varieties will undoubtedly continue to be made. However, for years to come all areas, except Egypt, will have to recognize that basic cotton improvement work cannot safely be entrusted entirely to native workers. Thus such areas will have to rely, to a substantial extent, upon Europeans or other "outsiders" for carrying out this important function.

Production Practices

The widest of ranges is found in cultural practices among cotton farmers in Africa. Contrast, for instance, the intensive irrigated production in the Sudan and in Egypt with the primitive hack-and-burn or bush farming in areas south of the Sahara.

In the large-scale Gezira Project, and in certain other isolated instances, extension workers and trained farm managers have gained adoption of the improved production practices that research and practical experience have shown to be advantageous. Generally, this has come about on those projects where the individual cultivator works under the comparatively close supervision of a trained agriculturalist, where the project management has the authority to see that prescribed practices are carried out, and where incentive is strengthened by the individual farmer's knowledge that other members of his tribe or people in other tribes will be assigned his allotment of land if he does not perform satisfactorily.

In contrast, most cotton south of the Sahara is produced under native culture, on land assigned to the individual cultivator under the particular system of his tribe. While he usually has ways of finding out the practices that are recommended, he is nevertheless free to accept the recommendations or ignore them.

Research workers in the various parts of Africa have tested and established several simple practices that are within the practical means of the great majority of native cultivators and that would make cotton a higher yielding and more profitable crop. Yield gains of 50 or 100 percent, and even more, are believed easy to achieve, if the native cultivator could be educated to adopt even a few of these practices. Recommendations vary for the different areas, but the lists generally include several of the following items:

1. Early planting.
2. Maintenance of fertility by means of rotations, including green manures and fallow.
3. Uprooting and destruction of stalks to provide "clean" period for insect and disease control.
4. Refraining from interplanting with other crops.
5. Timely thinning to stand.
6. Clean cultivation.
7. Early picking.

Advisers in some areas are also trying to teach the use of fertilizer and insecticides. The general belief is that it will be some years before native cultivators can be convinced that the effort and investment involved in all these improved practices are worth while.

Early Planting.--Research has revealed that date of planting has an important effect on yield. Nevertheless, cotton growers have a pronounced tendency to delay their planting beyond the time that would give best results. Various factors account for this laxness in following date-of-planting recommendations. Perhaps the most significant is the priority individual cultivators give to food crops.

In a highly commercialized cash-crop economy, such as is found in comparatively few areas in Africa, farmers frequently are said to put too much emphasis on the cash crop, reflecting the belief that the additional income would more than pay for the food they would not be producing. Of course, this presupposes that the cash crop is more profitable and has a ready market; also that there is food to buy. Frequently, this combination of circumstances is not present in African cotton-growing areas. For example, many have no general year-round local market in staple foods, and farmers feel compelled to put food production first. Except in those few areas that are well watered and fertile, most adults can remember years when not raising enough of this or that food meant being without for extended periods.

It is not surprising, therefore, that food crops enjoy a high priority with farmers in the vast majority of farming communities in Africa. In fact, they carry their preference for food crops to the point that it is hard to impress upon the average native farmer who has just finished planting his food crops that he should keep on working and get his cotton planted as early in the rainy season as possible. Despite the magnitude of the early-planting problem, the record of many African areas is one of progress. The outstanding example of a successful widespread effort to achieve earlier planting was the drive put on in Uganda in 1957. To this effort, which was conducted on a broad front, is due much of the credit for

Water from Blue Nile irrigates Sudanese field shown above. But much African cotton grows on small plots (left, Kenya).

Farmers bring cotton (above, Nigeria) to buying station (below, Uganda) for sale to ginnery (center, Tanganyika).

Much hand-weaving (above, Sudan) and marketing of cotton goods for home use (below, Kenya) goes on in open air.

Left, Mozambique cotton starts trip to mill in Portugal. Below (Sudan), neat bales await shipment from gin to port.

the fact that 52 percent of the crop was planted before the end of June and 83 percent before the end of July of that year, compared with a 1952-56 average of 28 percent by the end of June and 67 percent by the end of July.

Fertility Maintenance. --In most areas, research on fertility maintenance and improvement is in preliminary or exploratory stages, with most of the emphasis on determining practices that are within the easy means of most native cultivators. Most recommendations relating to the maintenance of fertility levels on land that is settled permanently involve such practices as rotations, fallowing, and the use of green and animal manures and straw mulches. Although the use of commercial fertilizer would result in sizable yield increases, the fact remains that there is no local production of chemical fertilizers, and imported fertilizers would be expensive. Also, the native cotton farmers in areas south of the Sahara are not at present of the temperament to invest in fertilizer, even if supplies and production credit were locally available. Land is not yet scarce enough, nor are the cotton farmers far enough absorbed into the world of commercial agriculture to be willing to spend money in the making of a crop. Also, many farmers would oppose such an open "tampering with nature".

Cotton is raised under almost every possible soil condition at one place or another in Africa. The rich irrigated river lands that grow most of Africa's cotton are inherently fertile, but they call for careful handling so that the fertility level and structure of the soil will not be impaired. Inherently fertile soils also are found in other cotton-growing areas of Africa. Among them are the Fertile Crescent of Uganda, certain areas of the Chad, the Kivu area of the Belgian Congo, and the Ruzizi Valley of Ruanda-Urundi. But most of the soils on which cotton is grown south of the Sahara would be considered fair to poor in comparison with the soils on which cotton is grown in the United States. Excessive leaching takes place in many areas. In others the soil structure causes serious problems with water absorption and penetration. Some of the soils drain poorly and high water tables are encountered. Still others, particularly those in savannah and higher rainfall areas, are characterized by a thin layer of loam underlain by a deep layer of reddish lateritic material notorious for its poor structure and low fertility. While it is true that there are vast areas of land in Africa that could be put into cotton production, the acreage of really first-class land available for further expansion has definite limits, especially in the areas of high rainfall.

In some cotton-growing communities where there is a range in the quality of soil, it is not uncommon to find cotton growing on the infertile sandy soils least suited to it, for the admitted reason that such land is easier to clear and farm. In Mozambique, the Centro de Investigação Científica Algodoeira, or CICA, works to delineate the soil areas that are well suited or ill suited for cotton. This important phase of their work is in addition to the phases of research that characterize the cotton investigations of most other African areas. Similarly, in the Belgian Congo careful soil survey work and other research by Belgium's Institut National pour l'Etude Agronomique du Congo Belge, or INEAC, has paved the way for cotton production to be developed on a sound soil management basis.

One significant problem involved in maintaining the fertility level of African cotton soils is the land tenure system. In many of the areas south of the Sahara in which cotton is grown, the land is held under native law and custom. One traveling in such areas frequently hears the point made that this lack of individual ownership is a major reason why farmers are uninterested in safeguarding the fertility of their land. This undoubtedly has a strong basis in fact. It also seems to be true, however, that many farmers in Africa, as well as elsewhere, are unimpressed with the arguments favoring the use of practices to conserve or improve fertility and the soil itself. Such farmers probably would farm as their ancestors have done, even if they held legal title to their land.

Insect and Disease Control. --In no case is the indifference of the native cotton grower to modern production practices more strikingly apparent than in the control of insects and diseases. Both kinds of pests cause moderate to heavy damage every year.

Africans can be thankful that they are not plagued by the American boll weevil, but practically every other insect that attacks cotton in the American Cotton Belt is present in African cotton fields, and a number of others besides. Among the latter, the jassid and the red bollworm are probably the most severe and destructive.

Bacterial blight--also called blackarm, bacterial boll rot and angular leaf spot--is acknowledged to be the most serious disease of cotton in Africa. This disease also occurs in the American Cotton Belt but seldom, if ever, is its devastation as great as in many parts of Africa. Seedling diseases also cause damage and loss of stand. Both fusarium and verticillum wilt also cause losses in some areas as do the root rots and certain virus disorders.

Closed seasons and the discontinuance of production of crops that are known to be alternate hosts of cotton insects also have been effective in reducing insect damage in certain areas. Similarly the pulling, raking, and burning of cotton stalks, leaves, and other debris has helped control bacterial blight.

Modern insecticides have been tested at many of the experiment stations and demonstration farms with striking results. But, with a few notable exceptions, the farmer in the bush never uses them. The fact that most of the effective materials are toxic to humans when used improperly is an additional complication to the problem of bridging the wide gap between production under the control and management of trained agriculturists and production as practiced by the native cotton farmer.

Danger to humans is also taken into account in choosing active chemicals to be used in the treatment or dressing of planting seed. Mercurial compounds usually have proved more effective in reducing the incidence of bacterial blight and the seedling diseases than the copper compounds, but the latter are generally used for treating the planting seed distributed to the farmers because they are considered to be less toxic.

Despite the impediments to the use of insecticides, effective insect control pays such big yield dividends that cotton leaders in some areas are introducing their use. Demonstration plots have been established in many villages and volunteer farmers are supplied trial amounts of insecticides and supervision in their application. Although this clearly represents progress, much is yet to be done before native cultivators are willing and able to buy and pay for insecticidal materials and systematically carry out an insect-control program on a basis broad enough to affect total cotton production significantly. A part of this total undertaking lies in the normal sphere of agricultural extension. In addition, however, there is the need to develop the distributive channels and regulatory systems for insuring that suitable insecticides are locally available.

Biological control of insects and disease--particularly the development of resistant or tolerant varieties--is a worthy objective of a cotton improvement program anywhere. In Africa, for the reasons already discussed, this approach to insect and disease control is a practical necessity and therefore a part of every plant-breeding program. Notable success has been achieved in developing strains that are resistant to the jassid. Density and length of plant hairs are known to be associated with jassid resistance. The Upland varieties in production in Africa are all quite hairy as compared to commercial varieties in the United States and all are moderately to highly resistant to the jassid. At several experiment stations in Africa research on resistance to insects other than the jassid is in progress.

In Africa an equally good job of breeding has been done in developing varieties resistant to bacterial blight. This phase of the work claims the major part of the attention of plant breeders at several of the stations. All station workers and others responsible for cotton production programs realize the folly of distributing seed of a variety that has not shown a reasonable degree of resistance to the disease. Research designed to develop higher resistance to the cotton wilts and certain other diseases, including the virus disorders, also is under way at several locations.

Other Practices.--In comparatively dry areas, there may be recommendations on maximum usefulness of available rainfall. An example of this is the recommended use of high flat ridges and tie furrows on the hill sands of Lake Province in Tanganyika. Different but corresponding recommendations might relate to disposal of excess rainfall where this poses a problem. Straw mulches have proved beneficial in a number of areas where the problem of water penetration and absorption exists.

Recommended harvesting practices include prompt and careful picking and storing of seed cotton. They also call for hand separation of easily removable trash and the removal of imperfect locks from otherwise clean white cotton. Since farmers sell their cotton in the seed, such a practice helps to maintain a high average quality of their top grade of seed cotton.

Research and Extension Activities. --In all aspects of the production processes discussed in this part of the report, the role of the research and extension workers is of far reaching importance. On their shoulders rests a large share of the responsibility for discovering how to improve numerous aspects of crop production in African areas and of doing the educational job of getting the improved practices adopted. The various agricultural departments, or ministries, and their field organizations make important contributions to this objective. So do the professionally trained personnel of some of the large ginning firms.

Except in Egypt, where the research work on cotton breeding and production is done by the Minstry of Agriculture, all other important cotton areas in Africa rely in part, or in whole, upon specialized cotton research agencies for basic and applied research relating to cotton. The Empire Growing Corporation (ECGC) currently, or in the fairly recent past, has operated in Kenya, Nigeria, Nyasaland, Southern Rhodesia, Sudan, Tanganyika, Uganda, and the Union of South Africa. The Institut de Recherches du Coton et des Textiles Exotique (IRCT) operates in the areas formerly known as French West Africa and French Equatorial Africa. The Belgian Congo and Ruanda-Urundi are served by l'Institut National pour l'Etude Agronomique du Congo Belge (INEAC) and Mozambique and Angola are served by the Centro de Investigação Científica Algodoeira (CICA).

Competition for Resources

Cotton in Africa finds itself subjected to nearly every degree of competition for resources used in production. In Egypt, and along the Nile in the Sudan, cotton cultivation is so deeply entrenched in the economy of cotton-growing sections that it is clearly the crop around which most farms are organized. The same is true to a greater or lesser extent in a number of other local areas.

South of the Sahara, however, cotton has much greater competition from food crops, since the most important task of any farmer, taking his own standard of living into account, is to produce enough to eat. In parts of this area, such as in the Fertile Crescent of lower Uganda, the climate is so favorable and the soils so rich that subsistence is not difficult if the farmer has enough land and is willing to work. Where nature is less generous, however, food and shelter frequently require a large share of the effort farmers are able and willing to exert. In such situations, the response to price changes may be quite different from the response in areas more oriented around the production of cash crops.

An important aspect in the competition of cotton for resources is tied up in the question of which factor is the "limiting" one in any given case--labor, land, water, etc. The most obvious limitation in many areas is water. This is abundantly clear in the irrigated sections along the Nile in Egypt and more especially in Sudan, where the line of demarcation between land that has water and equivalent-quality land that does not have water presents a sharp contrast.

Though to a less spectacular degree, water is a limiting factor in other areas as well. The total amount of water and its seasonal distribution are both important, for even where total moisture is sufficient for successful cotton production, the distribution may be such that after the food crops are started, there is not enough moisture left for a good cotton crop.

It may surprise many Americans to learn that availability of labor--or rather the lack of greater availability--limits the expansion of Africa's cotton production. In a number of places where cotton is comparatively popular, there is ample land available for a sizable expansion of production, yet the available labor supply is more or less fully engaged, as far as ability and willingness to work are concerned.

Related to labor availability is the general attitude of farmers regarding the crop. In Egypt, cotton has been the economic mainstay of the economy through several generations. Egyptian cotton farmers like the crop and do not appear to mind its exacting cultural requirements. In many newer producing areas south of the Sahara, however, the attitude toward cotton as a crop is less enthusiastic. Cotton demands a lot of work and a fairly exacting sequence of operations, if the resulting crop is to be profitable. Also, to some natives, cotton is still thought of as an "introduced" or "Government" crop and it arouses less interest than the traditional food crops.

Coffee, on the other hand, is relatively easy to produce, since, once it is planted, the annual labor requirements are not large, and the timing of operations is generally less exacting. In recent years, coffee also has had the advantage of being more attractively priced than cotton. Consequently, on land suitable, from the standpoint of soil and climate, for the production of both products, such as parts of the Ivory Coast, former French Equatorial Africa, the Belgian Congo, and Uganda, there has been a significant shifting from cotton to coffee.

Available land resources are called upon to support dense populations in some areas of Africa. With the present level of crop yields, a large share of the available farm land must be used to supply local food needs, and opportunities to produce cotton or other nonfood cash crops are limited. Under such circumstances, cotton production could expand only if cotton yields could be materially raised, or if yields of food crops could be raised to such an extent that some land could be shifted from food to cotton without reducing food production.

In some communities the local agricultural officials, and public officials generally, are actively promoting expanded cotton acreage. This effort may be motivated by the importance of foreign exchange earnings to the African area or of foreign exchange savings to a European country with which it is closely integrated. Some of those promoting expanded cotton acreage are employees of firms that engage directly in the cotton business in such capacities as ginners, and therefore are guided by the profit motive. These influences are important. However, perhaps of equal, or even greater, importance is the recognition that the expansion of a cash crop, such as cotton, can be a means of lifting the level of living of people in literally thousands of native villages.

Soils also play an important part in the determination of the best cash crop for any given area. This is illustrated by the fact that in some areas the agricultural officials refer to the tropical black clays as rice soils if too much water is available for cotton, or as cotton soils if they are sufficiently well drained. In still other areas, the more sandy soils are recognized as better suited for peanuts than for cotton. Such soil differences suggest that under any given set of cost and returns relationships, there are some soils on which cotton clearly enjoys a distinct advantage over other cash crops and other soils where cotton's competitive position might be affected by even fairly small differences in price and income relationships.

HOW COTTON MOVES IN TRADE

In most African areas where cotton is now grown, commercial production started on the basis of cotton's being an export crop. In a number of areas this is still the case, and in the aggregate about seven bales out of each eight produced in Africa move out of the country in which produced.

Wide variations are found in the way cotton goes to market in Africa, but a few general patterns cover most situations. The marketing of cotton by the African farmer is greatly different from that in the United States. Since the typical cultivator south of the Sahara plants only a very small area to cotton--sometimes less than one acre--it would not be possible for him to have his cotton custom-ginned and baled as does the American farmer. Instead, the marketing system is so organized that the farmer sells his cotton in the seed at the buying station nearest his village. These buying stations may be operated by the gin organization serving the area or by a local farmer cooperative. During the cotton-picking season, it is a frequent sight to see bundles of seed cotton carried on people's heads or tied to the middle of a pole which two people carry on their shoulders.

The typical procedure at the buying station is for the cotton to be graded into one of two grades. The top grade normally comprises some 90 to 95 percent of the total crop. It is then weighed, paid for at the established price, and emptied into the seed cotton warehouse at the buying station. Later it is placed in bags for hauling by truck to the gin served by the buying station. In some areas a minor public official is present at the buying station to insure that grading, weights, and payments are just. At times the local chief may assign a tribal representative who can read and write to be present and perform the function or to collaborate with the public official.

When the truck arrives at the gin with the bags of cotton loaded at the buying station, the load is weighed and the bag count is confirmed as an internal control for minimizing the chance that the same cotton will be purchased more than once. The bags are then stacked with other cotton of the same "grade" or emptied into bins of seed cotton of the same grade for eventual ginning.

Contrary to the typical situation in the United States, African ginning establishments, particularly those south of the Sahara, must provide for storage of large quantities of cotton in the seed. From this it can be seen that gin operators in Africa have had to decide how far to go in investing in gin machinery on the one hand and on the other hand, in storage space for unginned cotton.

There are wide variations in the gins in Africa. In the long-staple (barbadense) areas of Egypt and the Sudan, roller gins are employed exclusively. Roller gins are also used to gin Upland cotton in British East Africa. Elsewhere, with few exceptions, saw gins are used. The short coarse Isham-type (barbadense) cotton of the Ivory Coast, Togo, and Dahomey is ginned on saw gins.

Gins range rather widely in size and in the quantity of cotton ginned. This is partly illustrated by the situation on opposite sides of Lake Victoria. In the Buganda Province of Uganda there were 53 operating gins in 1958-59, and production of cotton in that year averaged slightly less than 1,900 bales (400 pounds) per gin. In the Lake Province of Tanganyika, on the other hand, there were 16 gins in operation, and production in 1958-59 averaged about 9,400 bales per gin. In both areas there was wide variation in the quantity of cotton ginned by individual gins.

Because of the variation in the quantity of cotton ginned per unit of ginning equipment, some gins have a much longer ginning season than others. Unless there is careful handling of the stores of raw cotton at the buying station and gin, it is obviously easy to have bright white cotton such as that picked early in the season mixed with other so-called top-grade cotton that may be dull in color because of weathering in the field. This would appear to be a greater danger in gins with a long ginning season than where the season is short. Currently, this entire range, if clean, would fall in the same grade, which in fact comprises all but about 5 percent of the crop.

Starting in 1958, Tanganyika has made an effort to minimize this practice by encouraging both prompt delivery from the buying stations to the gins and more orderly ginning. In time it may be decided that the best interests of the producing sections in various African areas will be served by the establishment of one or more additional grades of unginned cotton. Of course, such a change would involve a more complicated procedure at the local buying stations and gins, since it would add to both the grading problem and the storage arrangements for keeping the grades separated. Such changes by their very nature involve not only considerable psychological adjustment to the new and different procedure but also additional capital investment by those handling the seed cotton and doing the ginning.

The quality of the ginning that certain growths of African cotton receive is not all that it might be. Of course, the same can be said of most other producing areas of the world, but certain features in the African situation do distinguish it from a number of others. In parts of Africa, such as Uganda, Tanganyika, and Kenya, the gins, though owned privately or by cooperatives, do not operate with the independence generally characteristic of private business. In the first place they buy cotton on a fixed price basis from producers in the zone allocated to them. Also, when they have ginned the cotton they turn over both the lint and the seed to the appropriate lint and seed marketing board on a price basis designed to pay them cost and a reasonable profit for the services they have performed. This includes an incentive scheme designed to place more emphasis on grade. Nevertheless, this arrangement, taken as a whole, provides little if any incentive for them to improve, and at times even to maintain, the quality of the ginning operation. The power of public regulation has at times been employed to require gin improvements. While such a procedure can bring about improvement, it tends to do so only when the situation gets so bad that action can no longer be avoided, rather than at the earliest time that significant improvement can be made.

While ginning is sometimes recognized as being in need of improvement, packaging, on the other hand, is quite good. Since the cotton trade in Africa is not based upon the multiple sampling of all bales as is done with American cotton, the African bales reach consuming countries in comparatively good condition despite the repeated handling that frequently is involved in moving them from the gins in the interior.

The ginned cotton in some African areas is earmarked for shipment to particular European countries on the basis of a previously determined schedule of prices. In other areas the public board handling cotton sales arranges the available cotton into even running lots (generally of 50 bales each) and holds auctions or provides other means of selling at which private cotton firms may compete with one another for the lots of cotton in which they are interested. Seed not needed for planting is customarily sold either for crushing by a local oil mill or for export. However, in some remote regions such as Chad, it is not uncommon for the seed to be used to fire the boilers of the gin.

In most areas there is provision for a source of revenue to finance some form of development fund or cotton producer's welfare fund. In addition, some areas have a cotton price-assistance fund.

Some areas have a continuing source of revenue for these funds. In the Portuguese Provinces in Africa--Mozambique and Angola--the concessionaires pay into the fund a stipulated amount per unit of cotton handled. This contrasts with British East Africa and Nigeria where the fund was built up primarily from the wide spread between the farm price of the seed cotton and the sales price of the lint in a few years of high world cotton prices. In recent years the price paid the farmer for his seed cotton was calculated to be the full equivalent of the price that was expected to be received for the crop, after ginning and handling costs and the returns from seed were taken into account. Such a policy may cause any particular crop to result in either a "profit" or a "loss" with a consequent addition to or charge against the fund reflecting any error made in the estimate of the price received for the crop. Sometimes the established price in a given season has been deliberately fixed at a higher level than prospective world prices would appear to justify, in order to avoid year-to-year fluctuation or to soften the impact upon the producer of either reduced yields due to drought or a severe drop in world prices. Should the funds that have no regular source of annual revenue become depleted, the areas concerned would find it necessary to revise their policy to cope with the situation.

In Egypt and Sudan, the movement of cotton from the field to the outside world is quite different from that in most other African areas. In the case of Egypt, the chief difference is the manner in which the bales from the interior are opened, blended, and rebaled for export.

In Egypt much of the cotton is sold by the producer as seed cotton but some producers with a considerable volume of production have their cotton ginned for their own account. The ginning of seed cotton is so arranged as to result in even running lots of 30 bales. Some of the cotton export firms have their own gins in the producing areas and the cotton that they buy is customarily sold to domestic mills or shipped to Alexandria for eventual blending and sale to export customers. Cotton ginned at establishments that are not owned by the cotton export firms is also either sold to domestic mills or shipped to the gin's broker in Alexandria. There, samples are taken at random from some of the bales in each lot and the broker goes to the spot market at Minet-el-Bassal to work out a sale to one of the cotton export firms.

The cotton exporters hold the interior bales until the particular quality is needed for the making of a particular blended type. It is then opened, blended, and baled into the export-type bale, after which it is ready for shipment abroad.

The method of blending Egyptian cotton for export from Egypt has remained largely unchanged for many years. Meanwhile, production of extra-long staple cotton has reached such volume in other countries that Egypt now accounts for only about one-half of the cotton with a staple length of 1-3/8 inches and longer.

Although detailed cost data are lacking, the blending and rebaling operation in all probability raises the cost of moving Egyptian cotton from the gin to the consuming mill in a manner that lacks an equivalent in the case of competitive growths.

The indications are that within the trade this blending is accepted as a useful service. So long as Egypt held a near monopoly on extra-long staple cotton, the exporters of Egyptian cotton were in a fairly good position to protect their margin and cover the cost of blending and rebaling. But at present, the fact that world supplies of extra-long-staple cotton tend to exceed effective demand has depressed the level of prices outside the United States; and pressures might some day develop in Egypt for reducing merchandising costs where at all possible. The elimination of the blending operation might give some promise of increasing marketing efficiency, even though various obstacles would have to be overcome in the process. In the final analysis only time can tell whether such a basic change in merchandising practice will evolve in this comparatively small but very important segment of the cotton market.

So large a share of Sudan's cotton is under the direct control of the Sudan Gezira Board that its marketing practices dominate the marketing program for that country. Seed cotton arrives at the gin in large bags. It is graded into one of the six seed cotton grades and placed with other seed cotton of the same grade to await ginning. At the time of ginning the grade of the cotton is reviewed and a change in the grade of the bale is made if justified. The bales are divided into uniform lots, normally of 300 bales and the lots are shipped to Port Sudan where they are stored until sold and shipped. Usually, two or three bales of each lot are opened in order that cotton merchants can examine the sample bales and make comparisons with the official standards boxes and the pulling types established for the particular season. They also can obtain samples to send to prospective customers. After the cotton has been on display and announced for sale for a minimum of 2 weeks the lots are available for auction at the Khartoum sales office of the Sudan Gezira Board. Cotton is sold on grade equal to the standard grade boxes and on staple equal to the "Fair Average Quality" of the season as represented by the pulling types. Although the cotton is offered in lots of normally 300 bales, bids for a lesser amount are entertained.

DOMESTIC TEXTILE INDUSTRY AND COTTON CONSUMPTION

Although the textile industry in Africa dates back to before World War I, Egypt is the only country that produces most of the cotton textiles it consumes and the Belgian Congo is the only other area that produces as much as one-half of its own needs.

The role of the cotton textile industry in Africa relative to total cotton textile consumption can best be seen in data compiled by the Food and Agriculture Organization of the United Nations. According to this source, the industry's consumption of raw cotton aggregated 620,000 bales in 1957, the latest year for which these data are available. This represents 42 percent of the total quantity of cotton products made available for ultimate consumption during the year as against 15 percent in 1938 and 29 percent in 1948. Meanwhile, textile imports rose only moderately; thus, the dramatic expansion of Africa's own cotton textile production accounted for most of the increase in total consumption.

It is significant that the population of Africa increased 15 percent from 1938 to 1948 and 19 percent from 1948 to 1957 or 37 percent in all. These rates of increase are below the 19 percent, 42 percent, and 69 percent gains recorded during the corresponding periods in the total quantity of cotton products made available to consumers. In other words, not only has population been rising but the per capita consumption of cotton has also risen. Per capita availability actually increased from 2.4 pounds in 1938 to 2.6 pounds in 1948 and 3.1 pounds in 1957. Furthermore, there is every reason to expect these trends to continue in the foreseeable future. This situation has significance in relation to world trade in raw cotton and cotton textiles.

Egypt is by far the most important cotton textile producer in Africa, and its production continues to expand even though its share of the total is gradually declining. In 1938 raw cotton consumption in Egypt was nearly 80 percent of the total consumption in Africa. By 1948, Egypt's consumption had more than doubled, but its share of Africa's total was only 71 percent; by 1957 consumption in Egypt had doubled again, but Egypt's share was now 68 percent. In addition to accounting for two-thirds of Africa's raw cotton consumption, Egypt is the only African area that is a net exporter of cotton textiles.

The production of cotton textiles in a number of other African areas is growing in importance. In 1957 the Union of South Africa ranked second, with a raw cotton consumption of 55,000 bales. This was followed by the Belgian Congo, 45,000 bales; the countries of French West Africa, 22,000

TABLE 3.--Cotton products: Consumption, 1938, 1948, and 1957

Country	Raw cotton consumption			Net imports of cotton products			Available for home use					
							Total			Per capita		
	1938	1948	1957	1938	1948	1957	1938	1948	1957	1938	1948	1957
	1,000 bales	*1,000 bales*	*1,000 bales*	*1,000 bales*	*1,000 bales*	*1,000 bales*	*1,000 bales*	*1,000 bales*	*1,000 bales*	*Pounds*	*Pounds*	*Pounds*
Algeria....................	---	1	2	61	36	58	61	37	60	4.0	2.2	2.9
Angola.....................	---	1	2	11	14	27	11	15	29	1.5	1.8	3.1
Belgian Congo..............	7	25	45	21	34	38	28	59	83	.9	2.0	2.2
British East Africa........	---	---	2	47	72	89	47	72	91	1.5	2.0	2.2
Egypt......................	105	214	424	82	22	-62	187	236	362	5.5	5.7	7.3
Ethiopia and Eritrea.......	---	---	20	---	---	49	---	---	69	---	---	1.8
Federation of Nyasaland and Rhodesia..................	---	2	18	26	39	24	26	41	42	6.6	7.7	2.6
Fr. Equatorial Africa......	---	---	1	7	10	15	7	10	16	.9	1.1	1.5
Fr. West Africa............	13	10	22	52	47	92	65	57	114	2.0	1.8	2.9
Morocco....................	---	3	10	64	53	33	64	56	43	4.4	3.3	2.0
Mozambique.................	---	---	3	---	---	24	---	---	27	---	---	2.0
Nigeria....................	---	---	13	---	---	100	---	---	113	---	---	1.5
Sudan......................	---	---	5	39	36	74	39	36	79	2.6	2.2	3.5
Union of South Africa[1].....	1	22	55	104	144	118	105	166	173	5.1	6.6	6.0
Other......................	[2] 7	[2] 25	---	226	228	175	233	253	173	---	---	---
Total or average.......	133	303	620	740	735	854	873	1,038	1,474	2.4	2.6	3.1

[1] Including South-West Africa, Bechuanaland, Basutoland, and Swaziland. [2] Mostly Nigeria, which was not separately reported.

Bulletins of Food and Agriculture Organization.

bales; the Federation of Ethiopia and Eritrea, 20,000; the Federation of Rhodesia and Nyasaland, 18,000; and all other areas combined, 36,000 bales.

The tripling of raw cotton consumption in African areas other than Egypt between 1938 and 1948, the more than doubling of consumption between 1948 and 1957, and the further gains currently being made, all are evidence of the expansion of mill capacity that has been taking place. The newer mills have up-to-date equipment, and the African laborers have demonstrated their ability to make good textile workers. It is true, however, that labor turnover rates tend to be higher in some parts of Africa than in the world's leading textile-producing countries. This, of course, increases the problems of mill management.

If it is to be assumed that African areas will continue to experience rapid economic development--as certainly seems justified by all available evidence--it seems inevitable that additional textile mills will be built in various parts of Africa in the years ahead. It remains to be seen whether or not cotton textile output in Africa will rise faster or slower than the total demand for cotton textiles. For raw cotton, the important point is that the total consumer demand for cotton textiles seems likely to continue rising. In most areas of Africa the cotton mills will continue to draw mainly, if not entirely, upon local cotton, but probably other areas will continue to import some of the cotton they consume.

There is virtually no promotion of cotton textile consumption in African areas, nor any effort to educate the buying public as regards the advantages of some of the newer finishes that make cotton an increasingly useful textile fiber. Per capita consumption levels are admittedly low in that part of the world; but appropriate promotion, based upon both the needs of the area and the many worthwhile characteristics of cotton as a textile material for use in the tropics, might give gratifying results.

From an overall standpoint, the increased domestic consumption of cotton will mean that not all of the increased production of raw cotton in Africa will find its way into foreign trade. At the same time, it will mean that the countries accustomed to exporting textiles to African areas will not experience a gain in demand commensurate with the total growth in the African market for textiles. It is even possible that the African market for imported textiles may shrink. In this broad sense, therefore, changes in any country's raw cotton production, domestic mill consumption, trade in textiles, and ultimate consumption levels can be said to have a direct or indirect effect upon the raw cotton and cotton textile industries of all countries that rely importantly upon international trade in these fields.

PROSPECTS FOR COTTON DEVELOPMENT

Development Plans

Given anything resembling a continuation of the strong forces for economic growth throughout the world that have characterized the past decade, the available evidence points unmistakably toward continued expansion in cotton production in Africa, though not necessarily at the same rate as in the recent past.

Egypt. --In Egypt, there appears to be less opportunity for further expansion than in other major producing areas. Acreage seems likely to remain more or less stable unless, as the result of the union with Syria, Egypt is able to look to this new area as a source for food--particularly grains that it has heretofore been forced to produce on its own limited irrigated area. Such a development might permit Egypt to increase cotton acreage. The building of the High Dam at Aswan could indirectly serve the same end, but the best available Egyptian opinion stresses the belief that Egypt's great need in the future will be for food, and that the land that is to be brought into cultivation as a result of the High Dam is far better suited for food crops than for cotton. It is difficult, however, to rule out completely the possibility that some of this land would either go into cotton or cause a shift from food crops to cotton in some of the present irrigated areas.

From the standpoint of cotton production the principal Egyptian effort the last year or two has been in trying to overcome some quality deterioration that has shown up in several of its leading varieties. According to reports, this work has in all instances passed the plant breeding stage. It is now mainly a seed-multiplication problem with the accompanying work of safeguarding the purity of commercial seed stocks once present varieties have been replaced.

In view of the limited opportunities to expand acreage, Egypt attaches considerable importance to increasing the average yield per acre. One of the forms this effort takes is to promote expanded domestic production of commercial fertilizer and insecticides and also to increase and better direct their use. Efforts are being made to arrest the deterioration that has been occurring in the irrigation and drainage system and the consequent damage to the soil. Successful ventures along this line would prevent soil damage from occurring in some cases and in others, they would restore the productive level of soils that already have been damaged.

Sudan. --Cotton dominates both the present economy of the Sudan and many of its economic development plans. In two important respects, the situation in the Sudan differs markedly from that in Egypt. In the first place, Sudan has vast areas of land suitable, or at least potentially suitable, for farming. Much of this potential has sufficient rainfall for cotton production, and the remainder lies in such a way as to lend itself to irrigation, if certain engineering works are constructed. In the second place, population in Egypt is so great relative to land and water resources as to cause a real problem, while in Sudan the population level is so low that it may not be economically feasible to proceed with some of the development projects as fast as some elements in the economy would desire.

Currently, work is progressing on the Managil Extension. Plans originally called for this 830,400-acre extension to the present Gezira Scheme to come into production at yearly intervals in four stages, the first of which was planted in mid-1958 and the second in mid-1959. The timetable for the third and fourth phases, however, may be stretched out. For the most part, these delays stem from the strain that was put on the economy of the Sudan by the difficulty in selling the crop of 1956-57 and subsequent years. By late 1959 all old-crop cotton had been sold.

Much of Sudan's planned long-run expansion of cotton presupposes an increased quantity of irrigation water from the Nile and its tributaries, and the new Nile Waters Agreement negotiated in late 1959 assures an increased supply. Planning associated with building the Roseires Dam on the Blue Nile above the present Sennar Dam is receiving attention, and studies are being made of the readjustments that will be necessary when the area around Wadi Halfa is flooded by the High Dam Egypt is currently building at Aswan. There are strong indications that cotton will figure prominently in additional irrigated acreage, even though the Sudanese are becoming increasingly aware of the desirability of achieving a greater diversification in their economy.

The general intensity of cotton production on additional irrigated cotton land will be greater than on the original Gezira, where the rotation employed provided for cotton to occupy one-fourth of the total acreage. Since that pattern was established, experimental work has been undertaken with cotton occupying one-third of the acreage. The results were encouraging and commercial production set up on that basis has given satisfactory results. Grass and weeds tend to be more of a problem as a result of the land's lying fallow only 2 years out of 6 instead of 4 out of 8, but careful attention to plowing can offset this effect. Similarly, it appears that the indicated 10-percent reduction in yields can be offset by higher rates of fertilization.

By adopting this shorter rotation, the Managil Extension, according to the original development plans, will in fact have a larger acreage of cotton, once it comes into full production, than the present Gezira, even though it is one-fifth smaller in total area--approximately 277,000 acres of cotton, compared with 259,500 acres. It is virtually certain that this shorter rotation will set the pattern for other government irrigation projects in the Sudan, unless a still more profitable pattern should emerge in the meantime.

The Sudan has also encouraged the establishment of private pump schemes. The indications are that this will continue even though economic stress and the tight capital situation caused the government to ban the issuance of new pump scheme licenses for the 1959-60 season. Although the long-run trend of cotton acreage on private estates is upward, it is unlikely that cotton acreage there will show much if any increase until the profit situation improves and credits ease.

In addition to the planned further expansion in irrigated cotton production in the Sudan, an expansion is also possible in the acreage and production of Upland cotton under rain-grown conditions. There are believed to be large areas where cotton and various oilseed crops such as peanuts, sesame, and castor beans might represent suitable cash crops around which profitable farming operations can be developed.

Until very recently, almost all irrigated cotton in the Sudan was of the Egyptian type. In view of the tendency for supplies of extra-long staple cotton to outrun effective demand, some alarm has been felt both within and without the country over the indicated sharp further expansion in this type of cotton. Some observers have felt that production of the present varieties had pushed about as high as was feasible, and that most further expansion should be in varieties with other characteristics so as to give Sudan a more diversified cotton industry.

This has since become the prevailing view and Sudan has announced its intention to start commercial production of Acala-type cotton in areas of the Managil and the Gezira. On lands operated by the Sudan Gezira Board, some 8,000 acres of Acala 4-42 were grown in 1959-60. This virtually assures a sizable quantity of locally produced seed of this variety should the decision be made to plant this variety on parts of the Gezira or Managil Extension in 1960-61.

At the 1959 meeting of the International Cotton Advisory Committee the delegate from Sudan stated, "It is hoped that in the 1960-61 season over 200,000 acres from the existing area under extra-long staple cotton will be put under medium and short staple cotton. Thus in effect the area under extra-long staple cotton in the Sudan will within two years be very substantially reduced". It is to be presumed that the short staple varieties he referred to will be Egyptian-type or Upland-type varieties or some combination of the two.

While this would suggest that the total acreage of Egyptian-type cotton on government projects might decline, total acreage and production of cotton in the Sudan will inevitably continue to move upward and probably at a faster absolute rate than that of any other major cotton-producing area in Africa.

Other areas.--Plans exist in practically all other cotton-producing areas in Africa for further expansion in cotton production. In some areas the plans relate almost completely to the future, but, in others, programs are already well advanced, and it is possible to view their accomplishments. Many of these programs are conditioned, however, by the fact that south of the Sahara, cotton is grown predominantly by the native cultivator. For one thing, in many African areas there are major impediments to the entry of Europeans into farming. For another, Europeans who do engage in farming have shown little interest in cotton as a crop, though there are plantings by Europeans in some parts of Africa.

In Kenya, goals set by the government call for more than doubling cotton production within the next few years, but so far there has been less of a concerted effort to achieve the increase than in a number of other areas. Under prevailing conditions, yields are low, and the level of income from cotton does not give this crop any particular advantage over crops that are better liked because they are both edible and less exacting in their production requirements. Research data and numerous demonstration plots show how "easy" it would be for the producer to at least double the yield of cotton. Only time will tell, however, whether or not expanded cotton production will be actively encouraged in Kenya.

Cotton is perhaps as deeply entrenched in the economy of Uganda as in any African area south of the Sahara. At both the governmental and commercial levels the British, Indian, and native African leaders are keenly interested in the cotton economy of the area. The impact of such solidarity of thinking is indicated by the united effort that was made in 1957 to encourage farmers to plant earlier than customary. The impressive response of village leaders and local cultivators and even better cooperation in 1958 give reason to believe that in Uganda research findings pointing to more profitable cotton production may be adopted more promptly than in a number of other areas of Africa south of the Sahara.

In Tanganyika, also, the agricultural workers and native farmers have made great strides, in first finding out how to produce cotton profitably and then in adopting the improved practices. This teamwork and the consequent profitability of cotton is the sound basis underlying the spectacular expansion of cotton production, especially in the Lake Province. Research work is progressing in the Southern Province to assess the role that cotton might properly play in the agriculture of the area being developed under the auspices of the Tanganyika Agricultural Corporation. There is a widespread feeling, however, that even if experimentation continues to show favorable results, the total cotton acreage in the area will not be more than a few thousand acres for some years to come.

A serious effort is being made to sustain and, if possible, increase production of cotton in Northern Nigeria, where cotton and peanuts constitute the main cash crops. Professional cotton people in the area believe that cotton production has reached a plateau in the past few years and that production equal to that obtained in the favorable crop year of 1957 may not be expected in the foreseeable future. Progress will be slow, and most of the increase in production will come through the adoption of better farming methods. Cotton could encroach upon the sandy soils now occupied by peanuts if an economic situation should develop that makes peanut production relatively less attractive than cotton production. Some expansion of present cotton growing areas may take place and, if transportation facilities are extended, a few new areas might be opened up. However, it is the general belief that production in new or extended areas will be largely offset by reduced production in the older areas.

Poor transportation facilities and lack of competent labor appear to be the main deterrents to increased cotton production in the countries of former French Equatorial Africa, particularly Chad. At present, limited quantities of high-grade cotton are transported to deep-water ports by air freight. Most of the production is trucked to the river port at Bangui during dry periods and then forwarded to the seaport by barge and rail. The shipping costs are obviously high by either method of transportation. If projected all-weather highways or railroads, or both, are built, there is little doubt that the entire economy of the region would expand and accelerate. And cotton, in all probability, would play a leading part in the expansion. Also, in various other parts of Africa south of the Sahara, improvements in transportation will serve to stimulate agricultural development.

The same adverse factors as in former French Equatorial Africa are present in the countries that used to comprise French West Africa. Cotton production here is rather widely spread with substantial shares found in Ivory Coast, Upper Volta, Soudan, and Togo. After experiencing disastrous results with Egyptian cotton on the large irrigation project on the Niger River, the Office du Niger abandoned its plans to produce long-staple cotton. Upland cotton has, however, been grown for a number of years and may expand in this area to the extent that irrigation water not needed for growing rice and other food crops is available. Predictions on the trends of cotton production in the countries of former French West Africa range from no increase to very gradual increases over the next few years.

Cotton is produced on both sides of the equator in the Belgian Congo. Because of the alternating rainy and dry seasons in this situation, cotton is being produced and moved to the seaport or local mills practically the year round. Problems to be dealt with are similar to those encountered in the countries of former French Equatorial Africa and other cotton-growing areas south of the Sahara; but transportation facilities, including both roads and railways, are considerably more advanced and extensive. Still many cotton areas, particularly those in the northern regions of the Congo, are by no means adequately served. The regulation requiring farmers in certain designated areas to plant at least one-third of a hectare of cotton each year was removed in 1957. Thus, cotton production in the Belgian Congo is now on a voluntary basis. Removal of the regulation is not expected to result in an overall decrease in production. On the other hand Belgian Congo officials do not anticipate much, if any, increase in production during the next few years.

A vigorous effort is being made to expand cotton production in Mozambique and Angola. Each of the cotton-ginning companies has an assigned territory in which to operate. They are aware both of their obligation under the general cotton law and of the possibility of greater total profit if production can be increased. In addition to the work of the extension staff of these organizations, active encouragement of increased cotton production is given by CICA.

As a part of Mozambique's development program a sizable project has been started on the Limpopo River. A barrage of 650 meters' length carries both a highway and a railroad. It will be possible to raise the water level 4 meters and irrigate a sizable acreage. The project was started in 1953 and the first families from Portugal arrived at the start of the 1954 season. Plans call for each of the families from Portugal to have 4 hectares of irrigated land and an undivided 24-hectare share in an unirrigated grazing tract which will serve several families. An approximately equivalent additional area of potential irrigated land is held in reserve. Furthermore, it is visualized that some of the soil that is less suitable for intensive farming may eventually be used to establish some larger farms of 30 to 50 hectares and possibly some as large as 300 hectares.

Current plans call for cotton and rice to be the main cash crops. Each farmer will grow the one that seems best suited to his particular soil. The cash crop will be planted on one-half of his irrigated crop land each year, and it is expected that both the cotton or rice land and the other land will be double-cropped to food and feed crops. The Mozambique officials think of cotton--probably Egyptian-type--as the basic crop for the development; however, rice would be grown on the wetter soils.

All in all, it appears that cotton production will continue to expand in both Mozambique and Angola, but not rapidly. Although the Limpopo development scheme is an exception, the cotton leaders in Mozambique hope that increased yields rather than increased acreage will be the principal basis of any increase in cotton production that can be achieved. Nevertheless, farmers are being encouraged to start cotton production or expand acreage, and farmers who succeed in increasing yields on their present acreage--and therefore the profitability of cotton as a crop--may be encouraged by their success with the crop to expand their acreage.

The Government of Ethiopia has been interested in seeing cotton production expanded. With this view in mind, it requested and received help from FAO in the form of a cotton specialist to survey the situation in Ethiopia and make recommendations as to how cotton production might profitably be expanded. If the recommendations are followed, cotton production may well increase but in no event does it seem likely that at any time within the foreseeable future production will rise to more than a few thousand bales per year.

Impediments

In Africa as a whole, cotton will continue to grow in importance, although there are certain areas where cotton production is at a standstill, others where it is declining and still others where it would appear to have no future at all. It goes without saying that in areas that have a potential of producing more cotton than is currently being produced, there are significant impediments; otherwise production would already be higher.

In a number of African areas the excess of water as well as its deficiency is clearly a limiting factor. In part this can be overcome by the extension of existing irrigation or drainage projects or the establishment of new ones which may in turn depend upon additional engineering works. These additional irrigation and drainage facilities could bring substantial increases in agricultural production even though the area involved would be small relative to the total acreage of cultivable land in Africa. Such irrigation projects are large enough to be clearly beyond the means and capabilities of the individual farmer or tribal group. Because of their size and relative importance, they attract considerable public attention. This attention may extend far beyond technical agricultural considerations into social implications; the supply and demand prospects for the products that would be produced; and the financial, political, and legal aspects of the undertaking. Considerations directly involving cotton production and marketing may be minor compared with other factors. Furthermore, much time must elapse between the period when policy decisions are being made and the time when the project comes into production. During this period the relative economic position of the products involved may change materially.

While it is not feasible to influence the quantity of water made available to most of the actual or potential cotton-producing areas, much can be done that is not at present being done to increase the effective utilization of available water.

How to motivate the people to adopt recommended production practices is one of the major tasks confronting those who are seeking to bring about greater cotton production in Africa. Despite the progress along these lines made in limited areas, apathy on the part of the native cultivator continues to be a major impediment. In this connection, progress may have to be made on the side of food production before the cultivators in some areas will be willing to devote more attention to improved cotton production.

Other impediments are such general matters as maintaining the level of soil fertility and the physical condition of the soil, the property rights of farm families in the land they cultivate, and the low level of capital accumulation among farm families generally. Progress may be made in each of these areas in years to come but it is unlikely to be rapid.

Investment is a factor that clearly calls for mention. This is especially easy to see in the case of large projects such as the High Dam at Aswan, the Roseires Dam, the construction yet to be done on the Limpopo River Project, and even such undertakings as the private pump schemes along the Nile. Though less dramatic, it is none the less real in such additional public investment areas as the construction of highways and railroads, agricultural research and extension, and wells to supply villages with reliable drinking water. Additional investment is also required for modernization of gins and the erection of new ones. At the individual farm level greater investment in such simple items as a plow or a wagon could have a significant effect on cotton production if the farmers involved would employ such items to fullest advantage. The same is true for fertilizers, insecticides, fungicides, and simple machines for their application.

It is without prejudice that the transition of former colonial areas to full independence is mentioned at this point. This factor can have a profound influence on future cotton production. If on the one hand the transition turns out to be peaceful, the climate favorable to investment, and the employment situation favorable to retaining in the African areas a nucleus of highly trained and experienced European specialists for active participation and guidance in research and other phases of cotton development, the future of cotton in Africa might be governed largely by the normal economic considerations. On the other hand, cotton might make less progress or even decline in importance if there should be widespread unrest, uncertainty over the safety of investment, and a widespread exodus of those who now comprise so much of the leadership on cotton matters.

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